Lecture 25

Hoyt (1991)

1. Overview

   (a) The Epple-Zelenitz model is rich enough to allow a distinction between a tax on land and a tax on property (housing).

   We can therefore use it to answer the questions, which of these two taxes would communities choose in equilibrium? One can also explore the welfare implications.

   (b) Hoyt explores this question in the EZ model, except he uses *unit* taxes on land and property.

   The tax yield from a unit tax on land is not affected in any way by migration, since the quantity of land never changes.

   The tax yield from a unit tax on property is affected by migration since migration affects the quantity of housing.

   This stark distinction in the effects of migration would not exist with ad valorem taxes. The value of both land and property would be affected by migration.

   (c) Hoyt's basic thought experiment is the following. Suppose all regions can use only the land tax and we have an equilibrium.

   Now one region is given permission to use the property tax.

   Hoyt argues that the jurisdiction will do this. As it shifts to the property tax two things happen: population leaves and the land tax falls. As population leaves the costs of government falls, but so does the value of land. More formally, the net return to land is:

   $$p_L L - TL$$

   A shift to the property tax causes both terms to fall. Hoyt's claim is that overall there is an increase in the net return to land.

   Landowners take the opportunity to use a tax instrument whose yield increases with in-migration. He claims it acts as a congestion charge (Wilson disputes this interpretation, though).

   (d) Warning: Hoyt tends to use the word "optimal" when he means "what the optimizing goverment would choose." He is referring to an equilibrium value. It need not lead to an efficient allocations.

2. The Model

   (a) We stay with the EZ model. This creates two very minor differences with Hoyt.

      i. Hoyt models housing producers as small agents who buy bothl and capital. Thus, there is a market for land he models explicitly (more or less).
      EZ (and Henderson) is consistent with this, they just move directly to the aggregate supply technology. Land rent is then the residual left over after paying for capital. The price of land is this residual divided by the quantity of land (equation (4) below).

      ii. Hoyt does not regard income as entirely exogenous. He says, "Income is the return from the endowment of the private commodity and a share of land in one of the jurisdictions in the metropolis."
      There is a problem here. The prices of the private commodity and land do not appear in demand or indirect utility. It is alright to exclude the price of the private commodity since it is fixed both in and out of equilibrium. This is not true for the price of land, however.
      I am not sure what Hoyt is trying to accomplish with this. It is certainly easier just to stay with EZ's assumption of exogenous incomes.

   (b) We will build on the approach and the notation developed in the previous lecture. As in that lecture we will focus on the large numbers perspective.
   We suppress the superscript j. It should be clear from the last lecture that, in the large numbers case, this creates no problems.
   The total amount of land in the "metropolitan area" is $\bar{L}$. There are J regions, $j = 1, ..., J$. Each region has the same amount of land:

$$L = \bar{L}/J$$

   Each region has a constant returns to scale technology for producing housing out of land and capital:

$$F(K, L)$$

   Preferences:

$$U(g, h, b)$$

   The budget constraint contains the unit tax on property:

$$y = (p + \tau)h + b$$

   where p is the net price of housing and τ is the unit tax.
   Utility maximization gives:

$$h_d(g, p + \tau) \qquad (1)$$

$$b(g, p + \tau) \tag{2}$$

Profit maximization gives:

$$K_d(p) \tag{3}$$

We then define:

$$p_L(p) \equiv \frac{1}{L} \{pF[K_d(p), L] - p_K K_d(p)\} \tag{4}$$

$$h_s(p) \equiv \frac{F[K_d(p), L]}{L} \tag{5}$$

Market clearing gives:

$$Nh_d(g, p + \tau) = Lh_s(p), \quad j = 1, ..., J \tag{6}$$

$$V(g^i, p^i + \tau^i) = V(g^j, p^j + \tau^j), \quad \text{all } i, j \tag{7}$$

$$\sum_j N^j = \bar{N} \tag{8}$$

Each region is considered small (in the first part of the paper). The government perceives the seven local endogenous variables as defined by (1)-(6) plus the utility taking condition:

$$V(g, p + \tau) = V^* \tag{9}$$

The government chooses τ and g anticipating that the seven will be determined by (1)-(6) plus (9). The government also chooses T, but that does not appear in those equations. The key functions are:

$$p(\tau, g), \quad N(\tau, g) \tag{10}$$

$$p_L(\tau, g) \equiv p_L[p(\tau, g)] \tag{11}$$

(c) Landowner Objective

Landowners want to maximize net land revenue.

They set up a "puppet government" to provide public goods and require it to balance its budget.

Note that Epple-Zelenitz and Henderson do not assume budget balance; this is why I call this a puppet government.

The optimization is:

$$\max_{\tau, T, g} \; p_L(\tau, g)L - TL$$

$$\text{subject to:} \qquad N(\tau, g)\{\tau h_d[g, p(\tau, g) + \tau] - g\} + TL = 0$$

3. Analysis

(a) All we want to show is that the solution entails:

$$T = 0$$

We take the fewest derivatives needed to establish this result.

(b) From (9):

$$\frac{\partial p(\tau, g)}{\partial \tau} = -1$$

It then follows that:

$$\frac{\partial h_d[g, p(\tau, g) + \tau]}{\partial \tau} = \frac{\partial h_d}{\partial (p + \tau)} \frac{\partial [p(\tau, g) + \tau]}{\partial \tau} = 0$$

From (5) and (1):

$$\begin{aligned} \frac{\partial p_L(\tau, g)}{\partial \tau} &= \frac{\partial p_L(p)}{\partial p} \frac{\partial p(\tau, g)}{\partial \tau} \\ &= -\frac{1}{L} \{F[K_d(p)] + pF_K(K_d)' - p_K(K_d)'\} \\ &= -\frac{F}{L} \end{aligned}$$

(c) Writing the Lagrangian:

$$\mathcal{L} = p_L(.)L - TL + \lambda \{N(.)\{\tau h_d[g, p(.) + \tau] - g\} + TL\}$$

$$\frac{\partial \mathcal{L}}{\partial T} = -L + \lambda L = 0$$

Therefore:

$$\lambda = 1$$

$$\begin{aligned} \frac{\partial \mathcal{L}}{\partial \tau} &= \frac{\partial p_L}{\partial \tau} L + \lambda \left(N h_d + \tau \frac{\partial N}{\partial \tau} h_d + \tau N \frac{\partial h_d}{\partial \tau} - \frac{\partial N}{\partial \tau} g \right) \\ &= -\frac{F}{L} L + N h_d + \tau \frac{\partial N}{\partial \tau} h_d - \frac{\partial N}{\partial \tau} g \\ &= -L h_s + N h_d + \tau \frac{\partial N}{\partial \tau} h_d - \frac{\partial N}{\partial \tau} g \\ &= \frac{\partial N}{\partial \tau} (\tau h_d - g) \end{aligned}$$

Setting this equal to zero gives:

$$\tau h_d = g$$

(d) With τ set as above we must have $T = 0$ to satisfy the constraint. The property tax raises all of the revenue.

(e) As Hoyt says, the revenues collected from each resident equal the cost of providing the government service to him or her.

However, the outcome is still inefficient. The property tax is not a lump-sum tax.

4. Small numbers case

   (a) Note that at the start, Hoyt assumes the demand for numeraire and housing is independent of the quantity of local public good. In the notation of Epple-Zelenitz, this means $\gamma = 0$.

   This is a common simplifying assumption in this literature.

      i. Demand for housing and numeraire is of course defined by the budget constraint plus the requirement that the ratio of the marginal utilities equals the relative prices.
      The budget constraint is independent of g. So, both demands are independent of g if the ratio of marginal utilities is independent of g. The latter holds if the derivative of the ratio of marginal utilities with respect to g is zero. This is the condition in Hoyt's footnote 11.

   (b) The main finding in this case is that (a) if there is just one jurisdiction then it uses the land tax, (b) if there are many large jurisdictions they use both the land and property tax, and (c) as the number of jurisdictions increases the reliance on the land tax approaches zero.